

Impact of the covid-19 pandemic on physical education: Investigating basic motor skills, physical activity, fitness, and academic achievement

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ABSTRACT

The physical education learning process due to the covid-19 pandemic which resulted in students doing distance learning, limiting physical activity, and having to be physical distanced, became a challenge for students to be able to complete academic achievements in physical education. The purpose of the study of impact covid-19 on basic motor skills, physical activity, fitness, and academic achievement in Physical Education in 9-10-years-old School Children. Materials and methods this study were a correlation study, the object of as many as 80 elementary school students in the Lamongan district aged 9-10 years, who had a body mass index of 19-25 kg/m, normal blood pressure, and normal heart rate voluntarily became a study sample. Data collection for basic motor skills used TGMD-2, Physical activity used PAQ-C, and Fitness used the Indonesian Academic Achievement in Physical Education, Fitness Test used student report cards taken after one semester. The analysis sample used correlation with a significant rate of 0.05%. The result correlation showed that BMS and F were significantly correlated to AA but not correlated to PA ($p < 0.000$) whereas BMS was significantly correlated to PA and F using ($p < 0.000$). Conclusions of the study show that the impact of covid-19 affects learning achievement in Physical Education in 9-10-years-old School Children, variables that affect learning outcomes Physical Education are basic motor skills and fitness, while variables of physical activity and fitness directly affect the basic motor skills of students, then the learning outcomes of physical education in school programs are indirectly influenced by physical activity. Future research should conduct an investigation into the variables that are consistently associated with academic success in physical education among young children. This will provide a comprehensive understanding of the topic.

Keywords: Physical education; basic motor skill; physical activity; fitness; academic achievement

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INTRODUCTION

The covid-19 pandemic has led to the implementation of distance learning, which has resulted in limited physical contact between students and their peers. As a consequence, physical education has been adversely affected, impeding the ability of physical education teachers to effectively control and direct students' movement patterns during physical activities and sports (Varea & González-Calvo, 2021). While physical contact in physical education does not generally refer to inappropriate touch, it rather entails an agreement between the individuals involved regarding expectations in the context of physical education (Caldeborg et al., 2019). This issue is particularly significant for elementary school students, who heavily rely on direct guidance from physical education teachers in the learning process. The lack of sufficient physical contact in the pedagogical context of physical education hampers the optimal achievement of physical education learning outcomes in elementary schools, subsequently impacting students' motor abilities (Öhman & Quennerstedt, 2017). This condition can result in the achievement of physical education learning in elementary schools not running well, which will have an impact on students' motor abilities.

Physical education is closely associated with children's motor movements, physical activity, play, and sports, which are integrated with scientific knowledge to facilitate the growth and development of motor skills, emotions, and social abilities in line with national education goals (Rosdiani, 2013). Engaging in physical education enhances motor skills and increases overall physical activity (Knaus et al., 2020). Physical activities that involve movement and lesson plans focused on physical education consistently demonstrate a correlation with lower levels of moderate-to-vigorous physical activity (Zhou & Wang, 2019). Furthermore, physical education significantly impacts fitness, health, and fundamental motor skills, irrespective of the frequency or duration of physical education lessons, as its primary objective is to promote high levels of movement activity and fitness (García-Hermoso et al., 2020). By providing quality physical education, students can acquire knowledge, skills, and fitness, thereby becoming more active and engaged in physical activities (Chen et al., 2014). A study conducted by Zhou and Wang (2019) identified fifty-five studies correlating with moderate-to-vigorous physical activity (MVPA) among secondary school students in physical education (PE) lessons.

During the covid-19 pandemic, there was a significant reduction in children's physical activity and play, a pandemic-induced closures created obstacles for participating in physical activities (PA) by heavily relying on school and sports-based PA (Do, 2022). A decrease in physical activity among children is causing worry regarding the effects of the pandemic on their physical, the decrease in physical activity seems to be more prominent among children involved in organized team sports and those who have limited space and opportunities for regular physical activity at home or in their local area (Yomoda & Kurita, 2021). During the covid-19 pandemic, there was a decrease in physical activity in children and an increase in life habits that did not involve much physical activity (Suryoadji & Nugraha, 2021). However, childhood is an important period for learning fundamental motor skills, which include locomotor movements and object control. Locomotor motion refers to activities that involve body movement or changing places, such as running, galloping, skipping, hopping, sliding, and leaping. Object control involves the ability to manipulate and control objects, including throwing, catching, bouncing, kicking, striking, and rolling (Haywood & Getchell, 2021).

Research has shown a direct relationship between motor skill competence, cardiorespiratory fitness, and children's participation in physical activity (Ryu et al., 2021). Furthermore, motor abilities have an impact on early childhood cognitive development (Gashaj et al., 2019). Children with motor development difficulties often struggle with fitness-related activities (Cairney et al., 2017). Consequently, children who lack strong foundational motor skills may have reduced opportunities for physical activity, which can negatively affect their fitness and cognitive abilities.

Basic motor skills are closely linked to the prevalence of physical activity in both boys and girls (Logan et al., 2015). Regular physical activity not only enhances subsequent development but also improves psychological well-being by reducing stress, anxiety, and depression (Welis & Sazeli, 2013). The findings support the causal relationship between physical activity (PA) and motor skill development in children (McDonough et al., 2020). Complex motor intervention programmes can be utilised to stimulate both motor

and higher-order cognitive skills in prepubertal children (Van der Fels et al., 2015). It is crucial for children to engage in regular physical activity to enhance their motor skills and promote lifelong good health (Barnett et al., 2016; Goodway et al., 2019). A decrease in physical activity levels contributes to an increase in obesity and a decline in fitness among children (Robinson et al., 2015).

Based on relevant research on the relationship between motor skills, physical activity, and physical fitness, it has been found that aerobic fitness, rather than daily moderate-to-vigorous physical activity (MVPA), is positively associated with children's perceptual academic achievement (Pindus et al., 2016). Researchers are interested in exploring the connection between students' learning achievement in Physical Education during the covid-19 pandemic. Children who engage in regular physical activity tend to have good basic motor skills and fitness levels (Ryu et al., 2021). However, the impact of these variables on students' motor learning achievement cannot be determined without proper investigation.

Due to the restrictions on physical activity and the shift to online learning, students have been deprived of motor learning opportunities. Therefore, this study aims to examine the impact of Basic Motor Skills (BMS), Physical Activity (PA), and Fitness (F) on physical education learning outcomes, particularly in the context of covid-19, which has significantly affected academic achievement (AA). Investigating the significance of the basic motor skills, physical activity, and fitness in supporting physical education learning outcomes during the covid-19 pandemic is an intriguing area of study. This study aims to determine the relationship between Motor Skills (BMS), Physical Activity (PA), and Fitness (F) on physical education learning outcomes. The results of the study will help show that the impact of covid-19 greatly affects learning achievement in physical education of elementary school students. In addition, this study helps describe the information for students who have a lack of physical activity due to the covid-19 pandemic, as well as being the center of attention for all involved in child development.

METHOD

Participants

This study was correlation research, the object of 80 elementary school students in Lamongan district aged 9-10 years, who had a body mass index of 19-25 kg/m, normal blood pressure and normal heart rate voluntarily became research samples, all research objects were informed about the research process both orally and in writing before the implementation of the study by signing informed consent as a form of willingness as a participant in the study.

Study Organization

Data retrieval for basic motor skills (BMS) used TGMD-2 (Ulrich, 2000), Physical activity (PA) used PAQ-C (Voss et al., 2017) fitness (F) using Test Kebugaran Jasmani Indonesia (Fenanlampir & Faruq, 2015), for Academic Achievement (AA) used student report card scores taken after one semester of the learning process, the learning outcomes data taken include affective cognitive and psychomotor aspects (Kemendikbud, 2015), assessment of cognitive and psychomotor learning outcomes is contained on a scale of 10 to 100, while for learning outcomes affective aspects are contained in the description (Kemendikbud, 2014).

Statistical Analysis

The data were analyzed using the SPSS statistical program (v. 24, IBM Analytics). Kendal rank (nonparametric data) was used to test the initial relationship between Basic Motor Skills, Fitness and Physical Activity, and Incremental multiple regression analysis was used to identify variables that significantly predict physical education learning achievement. The analysis was run by gender. Alpha set at 0.05 priori.

RESULTS AND DISCUSSION

The participants included in this study were 80 elementary school students, 40 men and 40 women with characteristics aged 9-10 years, had a body mass index of 21.6 ± 2.11 , a height of 1.37 ± 0.06 , bodyweight

31.22 ± 3.20 as many as 80 remaining or (100%) were present in this study and had complete data on all variables for analysis. A complete description of the data containing the average and standard deviation is shown in table 1. When examining data between BMS and F significantly correlated to AA but was not correlated to PA use ($p < 0.05$; table 2), whereas BMS was significantly correlated to PA and F use ($p < 0.05$; tabel 2).

Table 1. Statistical Description for All Participants with Complete Data

No	Construct	Variable	All		Male (n=40)		Female (n=40)		p-value
1	BMS	Locomotor	42.94	±3.89	49.48	±3.52	42.40	±4.21	0.000*
		Object Control	41.99	±4.33	43.55	±3.15	40.43	±4.80	0.001*
		Cardiovascular	138.44	±33.56	159.47	±21.61	137.41	±40.61	0.006*
2	F	Muscular Strength	13.56	±5.51	16.93	±3.01	10.19	±6.18	0.000*
		Speed/Power	17.72	±85.74	8.03	±0.74	17.41	±121.24	0.000*
3	PA	Physical Activity	4.25	±0.50	4.31	±0.50	4.20	±0.50	0.363*
4	AA	Academic Achievement	84.63	±5.34	84.45	±5.33	84.80	±5.40	<i>n.s</i>

Description: *significant for gender; *n.s* non significant difference; BMS: Basic Motor Skill, F: Fitness, PA: Physical Activity, AA: Academic Achievement

Table 2. Correlation between Basic Motor Skill Measurement, Fitness, Physical Activity and Academic Achievement

Variable	Lokomotor	OC	Cardiovascular	MS	Speed/Power	PA	AA
Locomotor	1						
OC	0.070	1					
Cardiovascular	0.412**	0.356**	1				
MS	0.453**	0.391**	0.379**	1			
Speed/Power	0.688**	0.405**	0.585**	0.429**	1		
PA	0.434**	0.348**	0.379**	0.422**	-0.364*	1	
AA	0.562**	0.538**	0.434**	0.505**	-0.355*	-	1
						0.157	

Description: * $p < 0.05$; ** $p < 0.01$; OC: Object Control; MS: Muscular Strength; PA: Physical Activity, AA: Academic Achievement

Table 3. Predicting Academic Achievement from Locomotor, Object Control, Cardiovascular, Muscular Strength, Speed/Power

Sample	R-square	Variable name	B	SE B	Beta	t	p-value
All (80)	0.336	(Constant)	3.355	7.098		0.473	0.638
		Locomotor	0.175	0.067	0.106	2.621	0.000
		Object Control	0.828	0.141	0.206	5.876	0.005
		Cardiovascular	0.414	0.069	0.568	5.973	0.000
		MS	0.333	0.062	0.589	5.667	0.001
		Speed/Power	0.304	0.071	0.621	5.811	0.000
Male (40)	0.441	(Constant)	4.862	8.529		0.570	0.572
		Locomotor	0.188	0.049	0.375	3.823	0.000
		Object Control	0.442	0.902	0.063	0.490	0.627
		Cardiovascular	0.446	0.084	0.676	5.309	0.000
		MS	0.312	0.062	0.421	0.411	0.522
		Speed/Power	0.250	0.439	0.237	3.900	0.000
Female (40)	0.382	(Constant)	0.288	10.690		0.027	0.979
		Locomotor	0.237	0.092	0.349	2.594	0.005
		Object Control	1.498	0.139	0.578	10.782	0.000
		Cardiovascular	0.384	0.104	0.493	3.705	0.001
		MS	0.440	0.072	0.519	0.502	0.001
		Speed/Power	0.150	0.281	0.397	3.700	0.000

Description: MS: Muscular Strength

Performance in Academic Achievement was significantly correlated with locomotor, object control, cardiovascular, muscular strength, speed/power after examining the sample as a whole (R-square: 0.336; $p <$

0.001) male alone (R-square: 0.0441; $p < 0.000$), female alone (R-square: 0.382; $p < 0.001$). When examining the uncombined samples showed that locomotor, cardiovascular, and speed/power were significant factors in predicting Academic Achievement in Physical Education for the male sex, object control, and MS correlated with Academic Achievement in Physical Education for girls but not in boys.

Table 4. Predicting Basic Motor Skills, from Physical Activity, Cardiovascular, Muscular Strength, Speed/Power

Sample	R-square	Variable name	B	SE B	Beta	t	p-value
All (80)	0.448	(Constant)	5.215	0.914		5.703	0.000
		Physical Activity	0.125	0.019	0.195	6.579	0.001
		Cardiovascular	0.183	0.017	0.339	7.765	0.000
		MS	0.339	0.068	0.255	4.985	0.003
		Speed/Power	0.343	0.079	0.108	4.342	0.003
Male (40)	0.396	(Constant)	4.937	1.367		3.611	0.001
		Physical Activity	0.114	0.042	0.131	2.714	0.001
		Cardiovascular	0.135	0.023	0.372	5.870	0.003
		(Constant)	5.284	1.308		4.040	0.000
Female (40)	0.346	Physical Activity	0.114	0.042	0.131	2.714	0.001
		Cardiovascular	0.116	0.027	0.184	4.296	0.006
		MS	0.214	0.059	0.258	3.627	0.000
		Speed/Power	0.101	0.016	0.132	6.313	0.000

Description: MS: Muscular Strength

Basic motor skill performance was significantly correlated with cardiovascular physical activity, muscular strength, speed/power after examining the sample as a whole (R-square: 0.448; $p < 0.001$) male alone (R-square: 0.396; $p < 0.001$), female alone (R-square: 0.346; $p < 0.001$). When examining the uncombined sample showed that physical activity and cardiovascular were significant factors for predicting the basic performance of motor skills for the male sex. Physical activity, cardiovascular, muscular strength, and speed/power correlate to basic motor skills for girls but not boys.

This study aims to determine the impact of basic motor skills, physical activity, fitness on learning achievement in physical education due to the impact of covid-19. There are several findings in this study including a complete review that predicts learning achievement in student service education during the covid-19 pandemic. The predictions shown in the model specifically show that the variables contained in BMS and F, in the BMS attribute variables (locomotor and object control) and F attributes (cardiovascular, Muscular strength and speed/power) have a major impact on learning achievement in physical education. The results of the study report that students who have good BMS and F will make it easier for students to participate in physical education programs at school (Lopes et al., 2017). In addition, children over 9 years old who have good BMS and F performance will be followed by their academic performance compared to children who have lower BMS and F performance (De Bruijn et al., 2019), motor skills, and F abilities are beneficial to cognitive development as well as academic achievement (Haapala, 2013). BMS capability is basically better if given early which includes control objects and locomotors (Goodway et al., 2019). A specific model review that predicts variants in BMS variables is PA, as well as F. In the PA variable, it appears that it has an overall degree of correlation, this indicates that early childhood motor availability can be encouraged through an increase in PA, provide supportive proof that physical activity has a causal impact on the development of both motor abilities and cognitive skills children (Zeng et al., 2017). In addition, the development of BMS can be used as a basis for maintaining fitness until adulthood, although after adulthood the fitness decreases with age (Haga et al., 2015). In a specific model review that predicted the variants in BMS were PA, object control and locomotor significantly bound to their weekly total PA minutes referring to that the level of physical activity of children aged 10 years would be directly related to the basic component of motor skills. This was confirmed by the results of a study that stated that when active children are usually involved in sharing activity or physical activity. In other findings, it was shown that the total weekly PA minutes performed in schools through PE and extracurricular had more of an impact on F for

boys and girls. This was reinforced by the results of research that the F of boys and associations who were active in PE and sports/dance activities and their total pa week minutes (Chen et al., 2018).

It is very important for elementary school students aged 9-10 years to have good basic motor skills and fitness abilities, because these variables will affect learning achievement in physical education in school programs, while the variable ability of physical activity and fitness affects directly on the basic motor skills of students, then the learning outcomes of physical education in school programs are indirectly influenced by physical activity. These findings can generally be useful information for students who have a lack of physical activity due to the covid-19 pandemic, as well as being the center of attention for all involved in child development at the age of 9-10 years. Based on the results of the discussion presented in this study, it really needs more accurate information because it only includes a sample that is limited to children aged 9-10 years who come from South East Asia (Indonesia ethnic Java) and did not analyze based on the level of physical activity, moderate-to-vigorous physical activity (MVPA). Further research is expected to be carried out with a wider sample as well as from diverse ethnicities so as to provide better information.

CONCLUSION

The results of the study show that the impact of covid-19 greatly affects learning achievement in physical education of elementary school students at the age of 9-10 years, variables that affect learning outcomes physical education are basic motor skills and fitness in students, while variables of physical activity and fitness affect directly on the basic motor skills of students, then the learning outcomes of physical education in school programs indirectly affected by physical activity. Contribution of this research a generally be useful information for students who have a lack of physical activity due to the covid-19 pandemic, as well as being the center of attention for all involved in child development at the age of 9-10 years. Limitations in this study did not analyze based on the level of physical activity, moderate-to-vigorous physical activity (MVPA). Future research should conduct an investigation into the variables that are consistently associated with academic achivment in physical education among young children. As well as variables that affect BMS from Intelligence Quotient (IQ), Numeracy and Literacy, this will provide a comprehensive understanding of the topic.

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CONFLICT OF INTEREST

All author declare no conflict of interest.

REFERENCES

- Barnett, L. M., Stodden, D., Cohen, K. E., Smith, J. J., Lubans, D. R., Lenoir, M., . . . Morgan, P. J. (2016). Fundamental Movement Skills: An Important Focus. *Journal of Teaching in Physical Education*, 35(3), 219-225. <https://doi.org/10.1123/jtpe.2014-0209>
- Cairney, J., Veldhuizen, S., King-Dowling, S., Faight, B. E., & Hay, J. (2017). Tracking Cardiorespiratory Fitness and Physical Activity in Children with and Without Motor Coordination Problems. *Journal of Science and Medicine in Sport*, 20(4), 380-385. <https://doi.org/10.1016/j.jsams.2016.08.025>
- Caldeborg, A., Maivorsdotter, N., & Öhman, M. (2019). Touching the Didactic Contract-A Student Perspective on Intergenerational Touch in PE. *Sport, Education and Society*, 24(3), 256-268. <https://doi.org/10.1080/13573322.2017.1346600>

- Chen, W. H., A Mason, S Hammond-Bennett, A Zalmout, S (2014). Elementary School Students' Daily Physical Activity Behaviors: A Contributing Role of Quality Physical Education Teaching in Comprehensive School-Based Physical Activity Program. *Journal of Teaching in Physical Education*, 33(4), 592-610. <https://doi.org/10.1123/jtpe.2014-0060>
- Chen, W., Hammond-Bennett, A., Hypnar, A., & Mason, S. J. B. p. h. (2018). Health-related physical fitness and physical activity in elementary school students. *BMC Public Health*, 18(1), 1-12. <https://doi.org/10.1186/s12889-018-5107-4>
- De Bruijn, A. G. M., Kostons, D. D. N. M., Van Der Fels, I. M. J., Visscher, C., Oosterlaan, J., & Hartman, E., Bosker, R. J. (2019). Importance of Aerobic Fitness and Fundamental Motor Skills for Academic Achievement. *Psychology of Sport and Exercise*, 43, 200-209. <https://doi.org/10.1016/j.psychsport.2019.02.011>
- Do, B., Kirkland, C., Besenyi, G. M., Smock, M. C., & Lanza, K. (2022). Youth physical activity and the COVID-19 pandemic: A systematic review. *Preventive medicine reports*, 29, 101959. <https://doi.org/10.1016/j.pmedr.2022.101959>
- Fenanlampir, A., & Faruq, M. M. (2015). *Tes dan Pengukuran Dalam Olahraga*: Penerbit Andi.
- García-Hermoso, A., Alonso-Martínez, A. M., Ramírez-Vélez, R., Pérez-Sousa, M. Á., Ramírez-Campillo, R., & Izquierdo, M. (2020). Association of Physical Education with Improvement of Health-Related Physical Fitness Outcomes and Fundamental Motor Skills among Youths: A Systematic Review and Meta-Analysis. *JAMA pediatrics*, 174(6), 1-11. <https://doi.org/10.1001/jamapediatrics.2020.0223>
- Gashaj, V., Oberer, N., Mast, F. W., & Roebbers, C. M. (2019). Individual Differences in Basic Numerical Skills: The Role of Executive Functions and Motor Skills. *Journal of experimental child psychology*, 182, 187-195. <https://doi.org/10.1016/j.jecp.2019.01.021>
- Goodway, J. D., Ozmun, J. C., & Gallahue, D. L. (2019). *Understanding motor development: Infants, children, adolescents, adults*: Jones & Bartlett Learning. <https://doi.org/10.1016/j.jecp.2019.01.021>
- Haapala, E. A. (2013). Cardiorespiratory Fitness and Motor Skills in Relation to Cognition and Academic Performance in Children—A Review, *Journal of Human Kinetics*, 36(1), 55-68. <https://doi.org/10.2478/hukin-2013-0006>
- Haga, M., Gísladóttir, T., & Sigmundsson, H. (2015). The Relationship between Motor Competence and Physical Fitness is Weaker in the 15–16 yr. Adolescent age Group than in Younger Age Groups (4–5 yr. and 11–12 yr.). *Perceptual and Motor Skills*, 121(3), 900-912. <https://doi.org/10.2466/10.pms.121c24x2>
- Haywood, K. M., & Getchell, N. (2021). *Life span motor development*: Human kinetics.
- Kemendikbud. (2014). *Peraturan Menteri Pendidikan dan Kebudayaan Nomor 104 Tahun 2014 Tentang Enilaian Hasil Belajar oleh Pendidik pada Pendidikan Dasar dan Pendidikan Menengah*. Jakarta
- Kemendikbud. (2015). *Peraturan Menteri Pendidikan dan Kebudayaan Nomor 53 Tahun 2015 tentang Penilaian Hasil Belajar oleh Pendidik dan Satuan Pendidikan pada Pendidikan Dasar dan Pendidikan Menengah*. Jakarta
- Knaus, M. C., Lechner, M., & Reimers, A. K. (2020). For Better or Worse?—The Effects of Physical Education on Child Development. *Labour Economics*, 67, 101904. <https://doi.org/10.1016/j.labeco.2020.101904>
- Logan, S. W., Kipling Webster, E., Getchell, N., Pfeiffer, K. A., & Robinson, L. E. (2015). Relationship Between Fundamental Motor Skill Competence and Physical Activity during Childhood and Adolescence: A Systematic Review. *Kinesiology Review*, 4(4), 414-426. <https://doi.org/10.1123/kr.2013-0012>

- Lopes, V. P., Stodden, D. F., & Rodrigues, L. P. (2017). Effectiveness of Physical Education to Promote Motor Competence in Primary School Children. 22(6), 589-602. <https://doi.org/10.1080/17408989.2017.1341474>
- McDonough, D. J., Liu, W., & Gao, Z. (2020). Effects of Physical Activity on Children's Motor Skill Development: A Systematic Review of Randomized Controlled Trials. 2020. <https://doi.org/10.1155/2020/8160756>
- Öhman, M., & Quennerstedt. (2017). Questioning the No-Touch Discourse in Physical Education from a Children's Rights Perspective. 22(3), 305-320. <https://doi.org/10.1080/13573322.2015.1030384>
- Pindus, D. M., Drollette, E. S., Scudder, M. R., Khan, N. A., Raine, L. B., Sherar, L. B., Esliger, D. W., Kramer, A. F., & Hillman, C. H. (2016). Moderate-to-Vigorous Physical Activity, Indices of Cognitive Control, and Academic Achievement in Preadolescents. *The Journal of pediatrics*, 173, 136–142. <https://doi.org/10.1016/j.jpeds.2016.02.045>
- Robinson, L. E., Stodden, D. F., Barnett, L. M., Lopes, V. P., Logan, S. W., Rodrigues, L. P., & D'Hondt, E. (2015). Motor Competence and its Effect on Positive Developmental Trajectories of Health. *Sports medicine*, 45(9), 1273-1284. <https://doi.org/10.1007/s40279-015-0351-6>
- Rosdiani, D. (2013). *Perencanaan Pembelajaran dalam Pendidikan Jasmani dan Kesehatan*. Alfabeta. Bandung.
- Ryu, S., Lee, J. E., Zeng, N., Stodden, D., McDonough, D. J., Liu, W., & Gao, Z. (2021). Bidirectional Relationships among Children's Perceived Competence, Motor Skill Competence, Physical Activity, and Cardiorespiratory Fitness Across one School Year. *BioMed Research International*, 2021. 1-13. <https://doi.org/10.1155/2021/1704947>
- Suryoadji, K. A., & Nugraha, D. A. (2021). Aktivitas Fisik pada Anak dan Remaja selama Pandemi COVID-19: Sebuah Tinjauan Sistematis. *Khazanah: Jurnal Mahasiswa*, 13(1). 24-29. <https://doi.org/10.20885/khazanah.vol13.iss1.art3>
- Ulrich, D. (2000). *TGMD-2 Test of gross motor development examiner's manual*. Pro-ed. Texas.
- Van der Fels, I. M., Te Wierike, S. C., Hartman, E., Elferink-Gemser, M. T., Smith, J., & Visscher, C. (2015). The Relationship Between Motor Skills and Cognitive Skills in 4-16 Year Old Typically Developing Children: A Systematic Review. 18(6), 697-703. <https://doi.org/10.1016/j.jsams.2014.09.007>
- Varea, V., & González-Calvo, G. (2021). Touchless Classes and Absent Bodies: Teaching Physical Education in Times of Covid-19. 26(8), 831-845. <https://doi.org/10.1080/13573322.2020.1791814>
- Voss, C., Dean, P. H., Gardner, R. F., Duncombe, S. L., & Harris, K. C. (2017). Validity and Reliability of the Physical Activity Questionnaire for Children (PAQ-C) and Adolescents (PAQ-A) in Individuals with Congenital Heart Disease. *PLoS One*, 12(4), e0175806. <https://doi.org/10.1371/journal.pone.0175806>
- Welis, W., & Sazeli, R. M. (2013). *Gizi untuk Aktifitas Fisik dan Kebugaran*. Sukabina Press.
- Yomoda, K., & Kurita, S. (2021). Influence of Social Distancing during the COVID-19 Pandemic on Physical Activity in Children: A Scoping Review of the Literature. *Journal of exercise science and fitness*, 19(3), 195-203. <https://doi.org/10.1016/j.jesf.2021.04.002>
- Zeng, N., Ayyub, M., Sun, H., Wen, X., Xiang, P., & Gao, Z. (2017). Effects of Physical Activity on Motor Skills and Cognitive Development in Early Childhood: A Systematic Review. *BioMed Research International*, 2017. <https://doi.org/10.1155/2017/2760716>

Zhou, Y., & Wang, L. (2019). Correlates of Physical Activity of Students in Secondary School Physical Education: A Systematic Review of Literature. *BioMed research international*, 2019. <https://doi.org/10.1155/2019/4563484>